



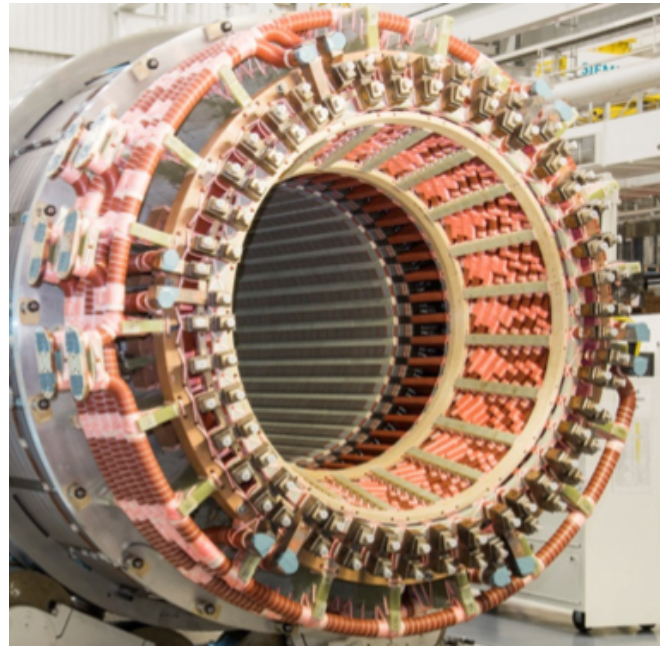
# Siemens Energy MICALASTIC® Global Vacuum Pressure Impregnation (GVPI)

Applicable for all generator products up to 22 kV

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The MICALASTIC® insulation system developed by Siemens Energy uses Global Vacuum Pressure Impregnation technology to provide excellent electrical, mechanical and thermal properties. Our GVPI system has a proven track record of industry-leading reliability since 1988.



### GVPI track record

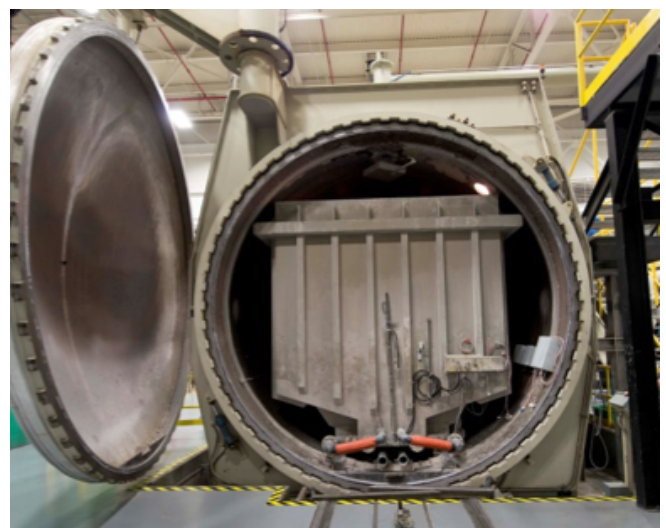
- > 1,700 stator windings in GVPI technology in turbine generators with a total output of > 240,000 MVA
- > 25,5 million operating hours and more than 322,000 start/stop cycles at a reliability rate exceeding 99.9%
- Fleet leaders with > 150,000 operating hours (OH) and 3,320 start/stop cycles

### GVPI design benefits

- Designed for more than 30 years of operation (electrical lifetime >100 years)
- Complies with all international standards (EN, IEC, IEEE, KEMA, API, etc.)
- Excellent and tight consolidation with axial flexibility allows for thermal expansion
- Soft coils enable lower stress installation and assembly process
- Low shrinkage insulation system and patented Outer Corona Protection (OCP)-System reduce vibration sparking and slot discharge

### Key Benefits

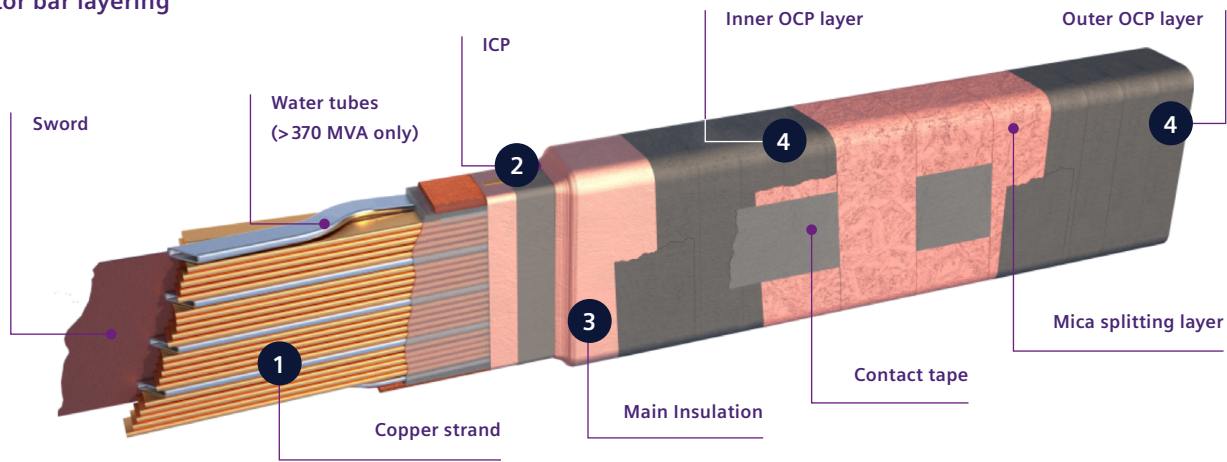
- > 99.9% reliability
- > 30 years operation life
- Industry-leading shrinkage control
- Allows for axial thermal expansion
- Robust coil and winding assembly
- Reduces or eliminates vibration sparking and slot discharge
- No re-wedging or re-tightening of end winding structure
- No re-tightening of stator core





## GVPI manufacturing excellence

### Stator bar layering



- 1 **Copper strand:** insulated, stranded copper, roebelled for performance benefits
  - 2 **Inner Corona Protection (ICP) system:** provides an equipotential sleeve to evenly distribute electrical field strength across the main insulation
  - 3 **Main insulation:** high performance class F Micalastic® insulation system with high-purity epoxy and discharge-resistant mica paper
  - 4 **Outer Corona Protection (OCP) system:** ensures constant electrical contact of the main insulation with the stator core
- **Three-layer patented external mica protection system in slot area:** designed for permanent electrical contact with grounded stator core
  - **Mica tape insulation across entire length of the stator bars:** continuous computer- automated and controlled application
  - **Semiconducting mica protection tapes at the slot ends:** designed for discharge-free voltage depression at slot ends

### Wound stator core assembly

- Pre-pressing of insulation before placement in the slot enables stress-relieved coil assembly
- Soft coils enable low stress assembly in the end winding region
- Significantly reduced stress on the coil insulation during installation of the bracing in the end winding region

### GVPI process

- Drying of the pre-heated wound core in the GVPI tank by evacuation prior to impregnation process
- Fully automated computer-controlled and monitored impregnation process to maintain uniform product quality
- Proprietary curing and cool down process ensures manufacturing robustness and highest level of quality
- Quality assurance in all phases of production with numerous mechanical and electrical tests



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**Siemens Energy Global GmbH & Co. KG**  
Freyeslebenstrasse 1  
91058 Erlangen  
Germany

For the U.S. published by

**Siemens Energy, Inc.**  
4400 N Alafaya Trail  
Orlando, FL 32826  
USA

**For more information, please visit our website:**  
[www.siemens-energy.com/generators](http://www.siemens-energy.com/generators)  
E-Mail: [sales.generator.energy@siemens-energy.com](mailto:sales.generator.energy@siemens-energy.com)

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